KWINIUK RIVER COUNTING TOWER PROJECT, 1972

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INTRODUCTION

A salmon counting tower project was initiated in 1965 on the Kwiniuk River 110 miles east of Nome (Figure 1). The eighth season of operation was completed in 1972. The Kwiniuk River, similar to other major rivers in Norton Sound, receives moderate runs of chum and pink salmon which are harvested by subsistence and commercial fishermen. To effectively manage the Norton Sound fisheries, it is important that frequent estimates of escapement during the season be obtained by either tower counts or aerial survey counts. The tower count is the more precise method and provides a check on the aerial surveys conducted.

OBJECTIVES

The 1972 project objectives were to:

- 1. Obtain daily and seasonal timing and magnitude of salmon escapements.
- 2. Determine the travel time required for salmon to migrate from the mouth of the Kwiniuk River, near the commercial fishery, to the tower site.
- 3. Evaluate aerial survey estimates by comparison with counting tower enumerations of salmon escapements.
- 4. Periodically sample the Moses Point commercial salmon fishery and the escapement populations for age, sex and size information.

METHODS AND MATERIALS

A portable 20-foot aluminum counting tower was erected adjacent to the river upon a 30-foot high bank at the same location used since 1965, approximately five miles above the river mouth.

A 25-fathom beach seine was used to block a secondary channel formed by a mid-river sand bar located across the main channel from the tower.

A power line with three 400-watt incandescent light bulbs housed in 18-inch diameter reflectors was strung across the main channel to provide illumination during darkness. A 1250-watt generator provided electric current for the lights.

A three-man crew began 18 hour counting operations on June 28 and terminated counting operations on July 27, 1972. Each crew member counted salmon for two 3-hour shifts daily from 1200 until 0600 the next day. Hourly counts were totaled. Salmon moving downstream and salmon caught above the tower for subsistence purposes were subtracted from the total count.

Chums were captured by seine at the mouth of the river, marked by plastic surveyor's marking tape (4 ft.) tied around the base of the tail, and released. The time of release was recorded and the time the fish were observed at the tower, five miles upstream, was recorded. Salmon were tagged and released in this manner in four different weeks. A different tape color was used each week.

One aerial survey of the Kwiniuk River was conducted from a chartered Cessna 180 aircraft.

The commercial fishery catches were periodically sampled for age, sex and size information at the buying station near the river mouth. The escapement population was sampled near the tower site using a beach seine to capture the fish.

RESULTS AND DISCUSSION

Estimates of Escapements from Tower Counts

In 1972 a total of 30,055 chums, 60,256 pinks and 65 kings was counted past the tower. Based upon research data from 1965-1969, the average chum salmon escapement during the six hours from 0600 until 1200 was 2.1 percent of the total run. The average pink salmon escapement during these hours was 3.66 percent. Using these figures, the expanded total escapements were 30,686 chums and 62,461 pinks. Daily cumulative counts for 1965-1972 are presented in Appendix Table 1.

The main peaks of the chum run occurred during the period July 6-12, while the peak of the pink run passed the tower during the period July 6-10 (Figure 2). The daily chum run was heaviest from 1900 to 0200 with the largest counts occurring from 2000 to 0100. The pink migration was greatest during a similar period, 2000 to 0100, with the peak occurring from 2000 to 2200 (Figure 3).

The chum and pink salmon average daily peak of migration for the years 1965-1969 was greatest between the hours of 1900 and 2000 (Appendix Table 2).

The 1972 chum salmon escapement was the fourth highest ever recorded. The pink salmon escapement was the third highest recorded. Total chum and pink escapements for 1965-1972 are presented in Appendix Table 3.

Commercial Fishery Catches

In 1972 the Moses Point commercial harvest of 31,227 chums was below the 8-year average of 33,283 chums (Table 1). The peak of the catch occurred on June 30. The pink salmon harvest of 5,773 was below the 8-year average of 6,703 pinks and the peak occurred on June 30. There is a very good correlation (.91) between catch per unit effort for chum salmon and escapement past the tower nine days later (Figure 4 and Appendix Table 7).

Forecasting Chum Salmon Returns Based upon Pink Salmon Escapement of the same Brood Year

In 1971 an estimate of the chum escapement past the Kwiniuk tower was made for 1972 and 1973 based on the escapement of pink salmon of the same parent year (Mattson, 1966). The projected escapement for 1972 of 110,112 chums was considerably larger than the actual escapement of 30,686 chums. The method and calculations are presented in Appendix Table 4. The previous chum escapements fit the regression line very well, and it is felt that the method should be tested for several more years to determine its validity. The projected escapements for 1973 and 1974 are 23,553 chums and 41,884 chums respectively. The 1973 escapement estimate of 23,553 chums is less than the previous 5-year average.

Travel Time of Chum Salmon

Travel times of chum salmon tagged near the river mouth are presented in Table 2. Of 18 salmon tagged near the river mouth, 8 were observed from the tower, 5 miles upriver. The fastest travel time was 9.5 hours and the slowest was 189.3 hours and the average time was 122.2 hours. The large variation in travel times was probably due to mixed river area stocks. The third group tagged on July 23 either spawned below the tower, passed the tower site after the project was terminated or were not observed from the tower.

This data may indicate that the late running chum spawn below the tower site, but extensive marking would have to be done before any valid conclusions can be drawn. The travel time for 1972 chums was 3-4 times larger than for 1971 chums (122.2 hours average for 1972 and 57.2 hours average for 1971).

Aerial Survey Estimate Compared to Tower Counts

An aerial survey of the Kwiniuk River was conducted on July 23, 1972. A total of 15,750 chums and 21,300 pinks was counted on that portion of the river above the counting tower site. The cumulative tower count through that date was 29,458 chums and 59,576 pinks, or slightly more than twice what was counted from the airplane. In the past aerial survey counts have ranged from 8 percent of the actual number of salmon to 125 percent. The average since 1965 has been 68 percent of the chums present, 38 percent of the pinks and 54 percent of the combined pinks and chums present. The comparison between aerial survey counts and tower counts since 1965 is presented in Appendix Table 8.

Population Sampling

Age, sex and length data: A total of 492 chums was sampled from the Moses Point commercial fishery and 483 chums were collected by beach seine from the spawning population of the Kwiniuk River. The fish were measured and age, sex and length data recorded. The scales collected were aged and the data will be tabulated in the Northern Region salmon age, sex and size data report, 1972.

SUMMARY

- 1. For the eighth consecutive year a counting tower project on the Kwiniuk River, a typical Norton Sound salmon stream, was operated primarily for the purpose of obtaining the daily and seasonal timing and magnitude of the salmon runs which can generally be applied toward management of the Norton Sound fisheries.
- 2. An expanded total of 30,686 chums and 62,461 pink salmon was recorded as passing the tower in 1972. The peak of the chum run occurred on July 6-12, while the pink run peaked during the period of July 6-10. The 1972 counts were the fourth highest for chums and third highest for pinks.
- 3. Chums tagged at the mouth of the Kwiniuk River took an average of 122.2 hours to travel the five miles up to the tower site.
- 4. Figures obtained from an aerial survey during the spawning season were approximately one-half of the actual escapement for that period.
- 5. Age, sex and size data was collected from both the commercial fishery and the spawning escapment population.

REFERENCES

- Mattson, Chester R. 1966. Forecasting chum salmon returns based upon pink salmon abundance of same brood year. USFWS Informational Leaflet No. 87. pp. 84-92.
- Hurd, Charles L. 1972. Kwiniuk tower report, 1971. A-Y-K Region Fishery Bulletin No. 8. Alaska Dept. Fish and Game. 21 p.

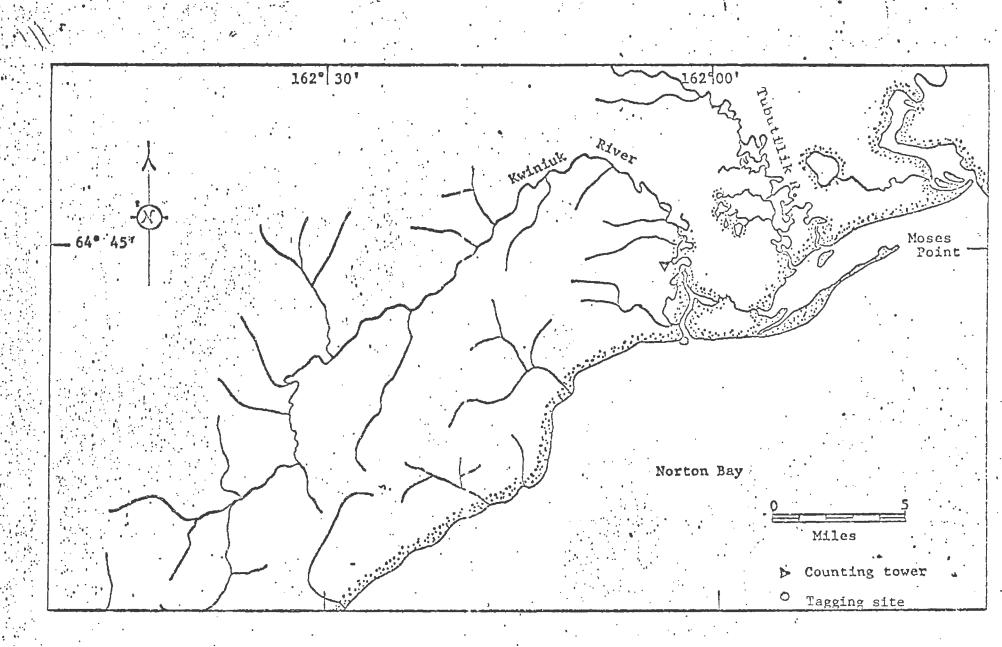
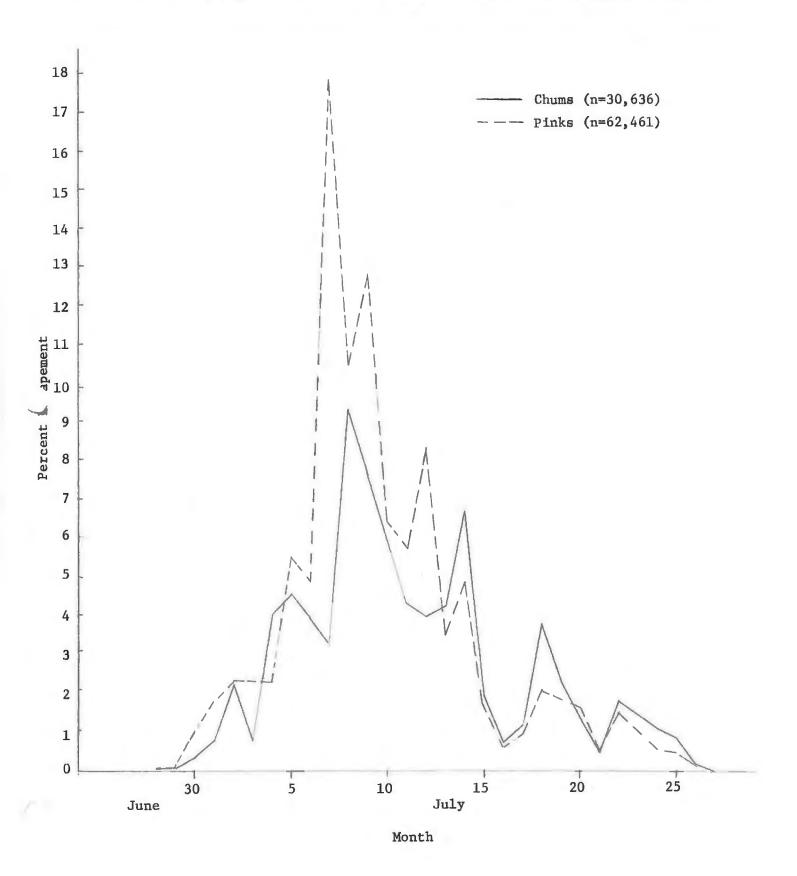


Figure 2. Daily migration patterns of chum and pink salmon, Kwiniuk River, 1972.



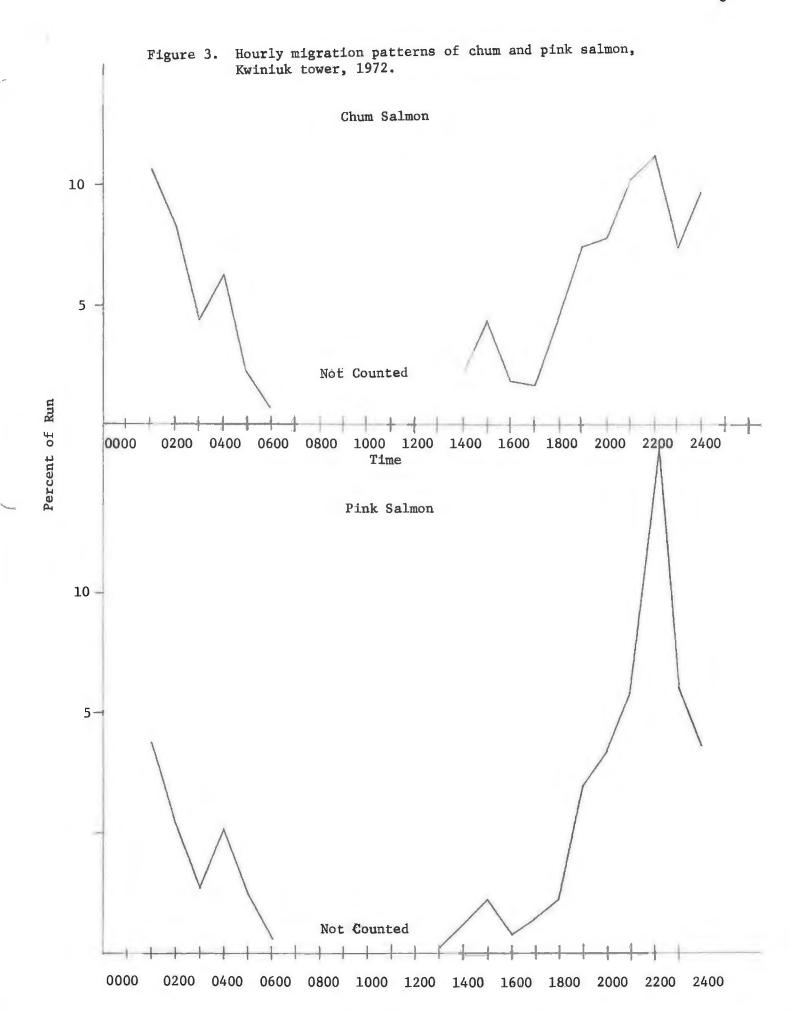
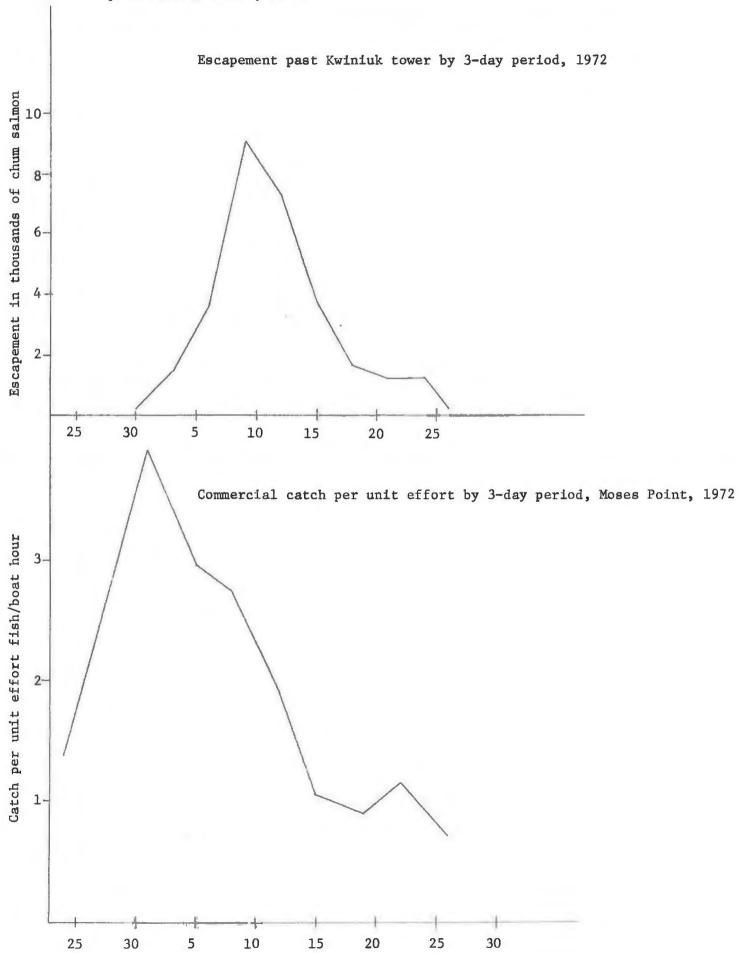


Figure 4. Comparison of timing of commercial chum catch (C/UE) with escapement past Kwiniuk tower, 1972.



July

June

Table 1. Moses Point subdistrict commercial catches by year.

Year	Chum	Pink
1962	50,683	11,100
1963	46,274	2,549
1964	28,568	3,372
1965	-	_
1966	24,741	2,745
1967	-	_
1968	17,908	9,012
1969	26,594	11,807
1970	29,726	13,052
1971	43,831	922
1972	31,227	5,773
Average 1962-1971	33,283	6,703

Table 2. Travel times of tagged chums, Kwiniuk River, 1972.

Tag color	No. tagged	Date and time of release	Date and time at tower	Travel time (hours)	Travel rate (Hours per mile)	Average travel rate hrs/mile
Yellow	10 chum	7/3/72 2200	7/5/72 2145 hrs. 7/5/72 2235 hrs. 7/9/72 2235 hrs.	48.5	9.5 9.7 28.9	16.0
Orange	2 chum	7/12/72 0430	7/14/72 1755 hrs. 7/17/72 2100 hrs.		12.5 27.5	29.5
Orange	5 chum 1 pink	7/16/72 2300	7/20/72 0129 hrs. 7/20/72 0440 hrs. 7/20/72 1750 hrs.	176.2	34.6 35.2 37.9	
Blue	l chum l pink	7/23/72 2330	No sightings			
Orange	1 pink	7/16/72 2300	7/22/72 0140 hrs.	122.61/		
Totals	18 chum		8	$\frac{979.2}{8} = 122$. 4	22.75

 $[\]underline{1}/$ Pink data not included in total.

Appendix Table 1. Daily total cumulative salmon escapement, Kwiniuk River, 1965-1972.

					YEA	R			~
Species	Date	1965	1966	1967	1968	1969	1970	1971	1972
Chum	6/18	6		1-1-1					
	6/19	· · · · · ·	24						··
	6/20		50	· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · · · · · · · · ·	
	6/21		158						
	6/22		506						
	6/23		759						
	6/24		1,048	_ 5					
	6/25		597	24	66		2		
	6/26		1,060	77	231	57	17	23	
	6/27	218	1,189	270	1,066	113		51	
	6/28	983	1,697	315	1,812	427		95	33
	6/29	2,576	1,768	1,455	2,838	571	645	139	51
	6/30	3,445	2,180	2,148	3,509	1,475	2,302	196	158
	7/1	7,741	5,728	2,739	4,443	2,057	3,327	452	697
	7/2	8,794	7,619	3,027	5,971	2,744	6,420	728	1,375
	7/3	9,988	8,054	3,491	6,914	3,861	14,467	1,181	1,607
	7/4	11,050	10,050	5,647	8,427	6,056	20,873	3,362	2,793
	7/5	12,078	11,958	6,157	9,409	7,137	26,699	4,783	4,143
	7/6	12,602	13,184	9,605	10,247	8,107	30,596	6,178	5,314
	7/7_	13,455	13,703	13,088	12,428	9,514	31,468	6,651	9,277
	7/8	13,824	15,703	15,691	15,033	10,568	34,695	10,677	12,100
	7/9	15,630	17,503	18,513	16,720	11,727	40,012	11,539	14,384
	7/10	19,147	17,472	21,487	18,003	12,197	40,362	13,401	16,242
	7/11	22,818	19,551	23,459	18,284	12,577	44,180	16,902	17,537
	7/12	23,491	24,549	26,165	18,349	13,200	47,305	18,694	21,735
	7/13	26,444	27,225	26,473	18,415	14,198	47,738	19,346	22,997
	7/14	32,026	27,579	26,495	18,431	14,879	50,304	20,566	24,998
	7/15	32,190	28,604	26,532	18,564	16,057	56,948	20,858	25,589
	7/16	32,437	28,336	26,584	18,590	16,364	60,275	21,909	25,805
	7/17	32,503	28,844	26,598	18,601	17,117	62,577	26,955	26,133
	7/18	32,861	29,965	26,625	18,636	18,345	63,065	27,836	27,284
	7/19		31,584	26,631	18,760	18,707	63,624	30,680	27,993
	7/20		32,154	26,681	18,815	18,918	65,673	33,800	28,371
	7/21		32,398	26,661	18,847	19,233	65,717	34,473	28,502
	7/22		32,723		18,907	19,373	66,062	35,237	29,020
	7/23		32,938	· · · · · · · · · · · · · · · · · · ·	18,951	19,390	66,176	35,510	29,458
	7/24		33,030		18,976	19,525	66,336	36,185	29,756
	7/25		33,137			19,554	66,545	36,959	29,995
	7/26		33,153			19,749	66,584	37,680	30,055
	7/27		33,184				66,599	38,107	
	7/28		33,182				66,602	38,186	
	7/29		/	,	/		66,604	38,243	
		-6,227		$-2,217^{2}$	$'$ - $163^{2/}$	<u> </u>	x 2.1%	x 2.1%	x 2.1%
		26,634	32,786	24,444	18,813	19,687	1,400	803	631
							+66,604	+38,243	+30,055
							68,004	39,046 _{2/}	30,686
								- 36/-	
								38,679	

^{1/ 1970} was the first year of 18 hour counts, 12 noon until 6 a.m. the next day. The average escapement for the hours from 6 a.m. until 12 noon for the years 1965-1969 was 2.1 percent of the total escapement for chums and 3.66 percent for pink salmon.
2/ Subsistence catch.

Appendix Table 1. (continued) Daily total cumulative salmon escapement, Kwiniuk River, 1965-1972.

					YEAI	_			
Species	Date	1965	1966	1967	1968	1969	1970	1971	1972
Pink	6/18								
•	6/19								
	6/20								
	6/21								
	6/22								
	6/23								
	6/24					·			
	6/25				·		3		
	6/26	·				17	13		
	6/27					19	16		
	6/28	174			48	41	17	9	15
	6/29	260			214	52	47	12	48
	6/30	220		<u> </u>	534	117	198	31	513
	7/1	276		1	755	131	298	125	1,490
	7/2	314	11	3	1,330	232	465	182	2,780
	7/3	349	29	44	1,732	378	1,096	241	2,899
	7/4	396	317	6	2,501	1,165	4,643	552	4,210
	7/5	388	517		3,141	2,259	10,949	819	7,564
	7/6	390	533		4,777	3,974	20,413	1,221	10,521
	7/7	412	568	18	13,719	6,415	20,159	1,327	21,264
	7/8	588	607	45	38,560	8,683	25,359	2,343	27,622
	7/9	650	673	521	67,509	11,406	30,729	2,490	35,297
	7/10	820	683	718	81,776	12,684	31,459	3,061	39,082
	7/11	1,120	722	1,282	105,977	13,539	39,601	5,963	42,529
	7/12	1,526	758	1,926	112,984	15,447	50,921	6,462	47,520
	7/13	1,653	817	2,685	113,323	18,250	52,800	6,994	49,581
	7/14	2,856	898	3,138	113,247	19,379	59,521	7,418	52,553
	7/15	4,488	1,205	3,160	114,504	25,056	90,681	7,519	53,539
	7/16	7,301	1,008	3,320	115,018	27,850	127,335	7,732	53,923
	7/17	7,456	1,206	3,348	117,172	34,863	148,750	9,646	54,483
	7/18	7,571	1,771	3,380	121,392	37,840	155,935	10,401	55,674
	7/19	8,668	3,269	3,406	124,510	43,897	161,963	12,470	56,721
	7/20		3,894	3,432	125,848	47,626	179,160	13,938	57,698
	7/21		4,190	3,567	127,088	51,943	185,247	14,571	57,997
	7/22		5,558	3,587	128,002	54,177		15,123	
	7/23		6,777		128,466	54,772	208,403	15,309	59,576
	7/24		7,843		129,052	55,741	214,233	15,485	59,892
	7/25		10,015			56,217	222,209	15,658	60,147
	7/26		10,691			57,497	225,546	15,818	60,246
	7/27		10,798				226,712	15,996	60,256
	7/28		10,864				226,829	16,089	
	7/29	2672	1 2252	$\frac{7}{79^{2}}$	/ 2 2002/	01/2	226,831	16,151	2 66%
		- <u>367</u> 2/				- 814 ²		x 3.66%	x 3.66%
		8,301	10,629	3,508	126,764	56,683	= 8,300	= 591 +16 151	= 2,205
							+226,831	+16,151	+60,256
							235,131	16,7422	62,461
								- 108 16,634	
- (<i>.</i>	-		counts, 12 i		1 (•	. The

^{1/ 1970} was the first year of 18 hour counts, 12 noon until 6 a.m. the next day. The average escapement for the hours from 6 a.m. until 12 noon for the years 1965-1969 was 2.1 percent of the total escapement for chums and 3.66 percent for pink salmon.

2/ Subsistence catch.

Appendix Table 2. Total counts by hour showing percentage of total count for the years 1965-1969, Kwiniuk tower.

Chums Species: 1965 1966 1969 Year 1967 1968 Hour Count Count % Count % All years 15 Count 19 Count 753 2043 6.27 904 2214 00-01 3.67 880 3.18 11.7 3.8 5.72 01 - 021938 5.95 1255 5.10 917 3.31 1355 7.1 356 1.8 4.65 02 - 03627 1.93 967 3.93 487 1.76 735 3.9 84 0.4 2.38 03-04 405 1.24 654 2.66 353 1.27 720 3.8 284 1.4 2.07 04-05 186 0.57 224 0.91 279 0.99 111 0.40 314 1.7 1.4 05-06 131 0.40 58 0.24 123 0.44 27 0.1 292 1.5 0.53 06-07 121 0.37 13 0.005 60 0.22 40 0.20 0.2 46 0.2 07-08 66 0.20 80 0.33 53 0.19 66 181 0.3 0.9 0.38 08-09 60 0.18 -250.0 16 0.06 22 0.1 186 0.9 0.24 09-10 9.0 67 35 0.11 -190.24 33 0.2 72 0.4 0.19 10-11 7 287 118 0.36 0.003 1.04 22 0.1 51 0.3 0.364 11-12 98 0.30 -2 0.0 -161 -0.5835 0.2 77 0.4 0.064 12-13 U.94 IGI 303 0.00 4.2 บ.บช้ -4 U.U 161 U.8 0.49 13-14 1523 4.68 147 0.60 495 .1.7969 0.4 1128 5.7 2.63 496 14-15 3386 10.40 483 1.96 440 4.27 1.79 2.3 963 4.9 15 - 161677 5.15 792 3.22 788 749 2.84 833 4.4 3,8 3.88 16-17 1556 5.57 4.78 1369 2937 10.6 879 1830 9.3 6.97 4.6 17-18 3961 12.16 1962 7.98 2519 9.09 698 3.7 2180 11.0 8.78 18-19 2777 8.53 2031 8,25 2304 8.31 1282 6.8 1995 10.1 8.39 19--20 2387 7.33 3836 1 13.8 1.0.66 3392 13.78 1947 10.3 1606 8.1 20-21 1863 5.72 2798 11.36 3600 13.0 1786 9.4 2109 10.7 10.03 21-22 2289 7.03 3523 14.30 3093 11.2 1409 7.4 1770 9.0 9.78 22-23 3082 9.47 2226 9,06 2412 8.7 1462 1180 8,18 7.7 6.0 23-24 1927 5.92 1574 6.40 2017 7.28 2586 13.6 1,470 7.4 8.12 100.0 Totals 32561 99.99 99.93 24574 27712 100.5 18970 19802 100.2 99.95

. 1

Appendix Table 2. (continued) Total counts by hour showing percentage of total count for the years 1965-1969, Kwiniuk tower.

Species: Pinks 1965 1966 1969 All years Year 1967 1968 Hour Count % Count Count % % % Count Count % 00-01 526 6.76 22 0.02 140 4.1 9974 7.6 3211 5.6 4.81 01-02 267 310 3.08 247 4.88 3.43 7.3 10457 8.1 1432 2.5 02-03 6.00 179 2.30 603 107 2403 270 2.74 3.1 1.8 0.5 03-04 142 1.82 428 4.25 113 3.3 2319 1.7 2227 3.9 2.99 04-05 80 7 1.03 57 0.06 0.2 2161 1.6 1833 3.2 1.21 05-06 81 1.04 28 0.03 15 0.3 0.5 1325 0.83 661 2.3 06 - 0758 0.75 10 0.01 14 0.3 431 0.3 158 0.3 0.33 07-08 3 19 2300 50 0.64 0.00 0.5 1861 1.4 4.0 1.30 08-09 5 22 0.28 4 0.00 0.1 796 0.6 842 1.5 0.49 09-10 17 **-**7 10 0.22 0.00 0.3 152 0.1 102 0.2 0.16 10-11 -31015. 0.287 1.12 0.00 0.4 317 0.2 116 0.38 11-12 95 1.22 -2 0.0026 0.7 227 0.2 C 0.0 0.42 12-13 90 1.16 -1 0.00 21 0.6 206 0.2 173 0.3 0.45 13-14 142 1.82 11 0.01 74 2.2 1395 1.1 2136 3.7 1.76 14-15 459 5.90 26 4.7 0.03 162 1796 1.4 1529 2.7 2.94 15-16 598 7.68 40 0.04 80 2.4 3711 2.9 2142 3.34 3.7 16-17 655 490 8.41 4.87 119 3.5 7701 6.0 4346 7.6 6.07 17-18 6.76 1221 526 12.13 227 6.6 14492 11.2 3445 8.53 6.0 8.45 18-19 546 7.01 851 240 7.1 6524 5.1 3153 5.5 6.63 19-20 534 6.86 1323 13.18 551 16.2 19821 14.8 4830 11.88 8.4 20-21 580 7.45 1822 18.18 377 11.44 11.1 8767 6.7 7928 13.8 21--22 770 9.89 1609 15.98 300 8.7 9921 7.6 49391 8.6 10.15 22-23 768 9.87 926 9.21 314 9.2 6.0 10137 7.8 3451 8.41 23-24 513 6.59 602 5.98 242 7.1 13092 10.1 5543 9.6 7.87

100.0

129382 99.0

1.00.1

43615

100.01

101.51 3425

Totals 7785

100.1

10066

Appendix Table 3. Chum and pink salmon escapements, $\frac{1}{}$ Kwiniuk River, 1965-1972.

Year	Chum	Pink	Total
1965	26,634	8,301	34,935
1966	32,786	10,629	43,415
1967	24,444	3,508	27,952
1968	18,813	126,764	145,577
1969	19,687	56,683	76,370
$1970^{\frac{2}{}}$	68,004	235,131	303,135
1971 <u>-2</u> /	38,679	16,634	55,313
1972 <u>2</u> /	30,686	62,461	93,147

Tower count minus upriver subsistence catch. Expanded data.

Appendix Table 4. Forecasting chum salmon returns based upon pink salmon abundance of the same brood year (Mattson, 1966), Kwiniuk River, 1972.

	Kwiniuk River B	Scapement Data	
	X	Y	
Year	Pink escapement	Chum escapement	Year
1/			
$1965\frac{1}{}^{/}$	15,834	24,444	1967
1966	10,629	18,813	1968
1967	3,508	19,687	1969
1968	126,764	68,004	1970
1969	56,683	38,679	1971
1970	235,131	30,686 (110,952 est.)	1972
1971	16,634	23,630*	1973
1972	62,461	41,618*	1974

Correlation coefficient for first five years .991

$$b = \frac{\sum xy}{\sum x^2} = .400$$

$$\overline{X} = 42.7 \times 10^3$$

$$\overline{Y} = 33.9 \times 10^3$$

$$Y - \overline{Y} = b(X - \overline{X})$$

$$\hat{Y} = 16.9 \times 10^3 + .4X = 23,553$$
 and 41,884

^{1/} The 1965 tower count was terminated before the end of the salmon run. The actual count of 8,668 pinks was expanded to include the percentage of pinks which pass the tower on an average year after July 19.

Appendix Table 5. Moses Point subdistrict (Norton Sound district) commercial catches by date, 1972.

Date	Chum	Pink
6/22	344	
6/23	950	***
6/24	412	60
6/26	1,566	94
6/27	3,011	785
6/28	1,003	231
6/29	818	151
6/30	3,969	828
7/1	3,666	446
7/3	136	
7/4	1,784	152
7/5	2,532	548
7/6	178	7
7/7	2,401	706
7/8	2,178	544
7/10	651	119
7/11	1,582	441
7/12	694	291
7/13	35	6
7/14	851	143
7/15	835	78
7/17	148	14
7/18	358	54
7/19	230	16
7/20	41	5
7/21 7/22	605	50
7/24	1 /	
7/25	14 33	
7/26	159	4
7/28	25	4
8/2	18	
	31,227	5,773

																			Daily	% of
lour	0	1	2	3	4	5	_12	13	14	_15	16	17	18	19	20	21	22	23	Total	Total Ru
ate							_													
lune 26																				
27																				
28	-	-	13	4	6	5	_	_	-	_	_	-	_	3	_	_	2	-	33	.11
29	_	_	3	5	-	_	-	~	_	_	_	2	_	_	3	5	_	_	18	.06
30	5	11	6	8	3	1					3	1	_	18	24	13	9	5	107	.36
uly 1	33	25	13	21	84	17				2	3	-	_	40	132	101	53	15	539	. 79
2	7	3	10	38	28	33	_	_	_	_	9	13	37	46	43	110	159	142	678	2.26
3	11	4	2	0	4	2	_	_	-	_	_	-	_	16	3	56	48	86	232	.77
4	124	365	203	81	32	8	_	_	_	_	_	_	5	23	154	27	60	104	1,186	3.95
5	275	131	75	51	19	10	2	_	_	_	_	2	2	4	71	129	167	412	1,350	4.49
6	385	237	156	114	5	4	_	_	_	_	1	_	_	8	4	8	70	179	1,171	3.90
7	372	386	297	506	47	2	_	_	_	3	47	384	304	97	402	804	289	23	3,963	13.19
8	787	562	122	68	68	10	_	3	55	11	243	272	158	42	28	200	105	89	2,823	9.39
9	228	43	40	2	1	1	_	_	_	1	2	2	3	45	686	550	317	363	2,284	7.60
10	115	207	31	35	13	3	8	4	29	9	_	_	26	75	163	444	244	452	1,858	6.18
11	42	7	9	21	48	3	_	_	_	8	15	99	121	420	81	123	68	230	1,295	4.31
12	241	89	19	17	21	14	70	532	1135	441	97	59	685	572	149	35	10	12	4,198	13.97
13	152	44	23	432	107	19	_	_	1	18	18	32	35	52	14	54	135	126	1,262	4.20
14	20	32	40	136	16	3	_	3	2	3	_	237	617	198	289	285	59	61	2,001	6.66
15	26	37	38	155	36	6	_	7	9	_	_	15	_	19	110	105	12	16	591	1.97
16	22	1	2	16	6	_	_	_	6	1	22	14	_	15	64	9	17	21	216	.72
17	28	34	22	11	4	2	_	_	_	_	1	2	37	11	47	69	24	36	328	1.09
18	26	_	28	18	19	14	_	31	7	4	2	_	100	188	430	58	150	76	1,151	3.83
19	41	34	20	16	11	8	2	6	í	1	_	42	21	90	35	55	148	178	709	2.36
20	29	16	33	3	14	1	_	_	_	_	5	142	30	35	10	19	3	38	378	1.26
21	7	11	_	1	1	2	_	21	18	2	1	2	_	4	2	3	2	54	131	.44
22	_	30	15	22	25	_	_		17	1	2	3	9	187	58	53	30	66	518	1.72
23	63	24	38	22	24	10	_	-	-	_	_	16	29	65	48	30	9	60	438	1.46
24	73	24	34	21	8	2	_		_	_	_	_	23	32	3	23	20	35	298	.99
25	7 5 5 9	68	26	29	17	9	_		_	_	3	_	1	7	4	4	5	7	239	.80
26	2	11	_	23	17		_	_	11	11	_		_	,	12	_	2	11	60	.20
27	_	- 11	_	_		_	_	_	 T.T.	T.T.	_	_		_	12	_	_	- 11	00	100.00
lourly															-					100.00
COTALS	3172	2436	1318	1853	667	189	82	607	1291	516	47/	1339	22/12	2312	3069	3372	2217	2897	30,055	
of	21/2	2430	1010	1000	007	102	02	007	1471	210	7/4	1000	2243	2214	3003	3314	2411	2091	30,033	
otal																				

7.7		-					1.0	1.0	1/	1.5	1.0	1-7	1.0	10	20	0.1	22	22	Daily	% of
Hour	0	1	2	3	4	5	12	13	14	15	16	17	18	19	20	21	22	23	Total	Total Run
Date																				
June 26		-	_	_	_	_	_	_	-	-	_	_	_	_	_	_	_	-		
27	_	_	_			0											2	_	15	0.2
28		-	5	_	_	2	_	_	_	_	- 5	_	- 7				3 11	5 2	15 33	.02 .05
29	7	1	-	_	1.0	-	_	_	~	_		_		_	116	223	75	11	33 465	
30	4	11	-	3	13	9					-	_	_ _	_	116 28	443	112	213	977	.77 1.62
July 1	31	15	23	44	38	12	_	_	_	_ 7	3	8 15	7 166	270	28 79		256			
2	25	21	13	15	18	22	_	_	5	7	11			27.8		198		161	1,290	2.14
3	12	7	3	-	3	5	-	_	_	_	_	-	-	20	252	13	13	43	119	. 20
4	62	97	59	90	63	10	_	_	_	_		_	32	58	352	111	93	284	1,311	2.18
5	344	175	152 293	80	34	6	6	_	_	_	2	5	26	53 19	377 46	1155 2	607 315	334 521	3,354	5.57
6	725 1049	411 718	325	438	159 88	17	-	_	_	<u>-</u> 4	63	289	9 614	669	1491	3740	1002	56	2,957	4.91 17.83
/	1432	918	200	615 240	263	18	-	2 30	- 217	49	602	357	507	144	48	720	335	251	10,743 6,358	10.55
8 9	482	52	53	12	203 13	45 1	_ 5	30	10	49	11	26	21	138	1690	2584	1792	783	7,675	12.74
10	142	153	49	53	13 48	1 4	41	13	34	11	_ TT	20 -	34	172	363	1068	547	1053	3,785	6.28
11	138	11	18	50	269	8	41 -	12	5 5	10	23	142		1227	205	449	369	333	3,447	5.72
12	153	135	15	33	43	34	62	497	855	370	80			1052	243	61	16	36	4,991	8.28
13	121	39	23	788	45 45	42	-	497	. 1	12	10	38	62	57	56	21	344	401	2,061	3.42
14	59	8	34	105	11	42	_	1	. <u> </u>	7	_	137	836	258	347	923	132	115	2,977	4.94
15	62	31	83	110	21	-	_	18	11	_	_	34	050	39	215	272	54	31	981	1.63
16	12	5	11	34	17	-4	_	10	22	6	12	20	_	20	98	44	41	46	384	.64
17	24	26	21	9	11	4	_	_	1	_	1	12	46	14	84	152	83	72	560	.93
18	68	_	15	19	25	14	6	57	42	12	6	-	48	117	299	96	202	165	1,191	1.98
19	60	17	18	14	14	19	3	11	2	6	_	42	57	133	38	278	175	160	1,047	1.74
20	31	56	53	32	84	12	_	3	1	2	18	374	90	108	28	38	5	42	977	1.62
21	12	43	9	15	3	3	3	16	27	16	4	13	26	20	10	9	11	59	299	.50
22	16	135	49	88	122	11	_	-	38	_	6	16	41	254	95	68	34	54	1,027	1.70
23	75	43	38	81	45	15	_	_	_	_	-	36	27	85	51	17	5	34	552	.92
24	34	38	49	30	15	3	_	_	_	_	2	_	11	29	10	28	25	42	316	.52
25	57	62	18	24	25	12	_	_	_	_	5	4	3	7	6	8	5	19	255	. 42
26	10	3	6		2		_	_	3	_	13	10	12	14	_	7	4	15	99	.16
27	2	2	1	5	-	_	_	_	_	_	_	_		_	_	_	_	_	10	.02
Hourly							-				·		<u>-</u>	-		-				
Totals	5249	3233	1636	3027	1492	328	126	649	1274	514	877	1631	4125	4985	6375	2728	6666	5341	60,256	
% of														·					-	
Total																				
Run	8.71	5.37	2.72	5.02	2.48	.54	.21	1.08	2.11	.85	1.46	2.71	6.85	8.27	10.58	21.12	11.06	8.86	100,00	

Appendix Table 7. Correlation between commercial catch per unit effort for three-day period and chum escapement past the Kwiniuk tower nine days later, 1972 (three-day period).

	Chum esc per 3-da	-			ial catch per 3-day	_
Period	X	X	Period	Y	Y	XY
7/1-3 7/1-6 7/7-9 7/10-12 7/13-15 7/16-18 7/19-21 7/22-24 7/25-26	1,449 3,707 9,070 7,351 3,854 1,695 1,218 1,254 299	210 x 10 ⁴ 1,374 x 10 ₄ 8,226 x 10 ⁴ 5,404 x 10 ⁴ 1,485 x 10 ⁴ 287 x 10 ⁴ 148 x 10 ⁴ 157 x 10 ⁴ 9 x 10 ⁴	6/22-24 6/26-28 6/29-7/1 7/3-5 7/6-8 7/10-12 7/13-15 7/17-19 7/20-22	1.36 2.84 3.91 2.99 2.75 1.90 1.09 .90	1.8 8.1 15.3 8.9 7.6 3.6 1.2 .8	1,971 10,528 35,464 21,979 10,599 3,221 1,328 1,129 377
	= 29,897	$17,300 \times 10^4$	•	= 19.00	48.9	86,596

Appendix Table 8. Comparison of aerial survey counts for Kwiniuk River with tower counts, 1965-1972.

			_	Percent aerial count
Year		Aerial	Tower	is of tower count
4045		1/		
1965	Chum	32,565	32,861	99
	Pinks	7,980	8,668	92
	Unidentified	$\frac{11,347}{51,333}$	<u>-</u>	105
		51,892	41,529	125
1966	Chum	-	33,182	-
	Pinks	-	10,864	-
	Unidentified	24,597	**	
		24,597	44,046	56
1967	Chum	16,722	26,661	63
	Pinks		3,587	guit.
	Unidentified		· -	_
		16,722	30,248	- 55
1968	Chum	15,630	18,893	83
	Pinks	16,870	128,580	13
	Unidentified	25,710	_	_
		58,210	147,473	39
1969	Chum	8,567	19,687	44
	Pinks	4,990	56,683	8
	Unidentified	4,965	_	~
		18,522	76,370	24
1970	Chum	70,400	68,004	104
	Pinks	138,950	235,131	59
	Unidentified		-	_
		209,350	303,135	69
1971 ² /	Chum	800	38,679	2
17/1	Pinks	60	16,634	3
	Unidentified	5,892	10,054	- -
	Unitabilitied	$\frac{5,052}{6,752}$	55,313	13
1972	Chum	15,750	29,458	53
1912	Pinks	21,300	59,576	36
	Unidentified	21,500	JJ, 570	50
	onidentii ied	37,050	89,034	42
TOTALS	Chum	160,434	234,243	68 8-yr. av.
-0-11110	Pinks	190,150	505,272 _{3/}	38 8-yr. av.
	Unidentified	72,511+	47,633	- Jo J-y1. av.
	* ***** ** * ***	423,095	787,148	54
		443,093	/0/,140	54

^{1/} Includes carcasses.

 $[\]frac{2}{2}$ / Too late in season for accurate aerial survey. $\frac{2}{3}$ / Tower counts which were not included chum, pinks, or unidentified.